Prevalence of Night Eating Syndrome and Its Interrelationship with Sleep Quality and Psychological Health

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A dissertation submitted in partial fulfillment

of the requirements for the degree of

Masters of Science

Supervised by

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SCHOOL OF HEALTH SCIENCE AND TRANSLATIONAL RESEARCH

SISTER NIVEDITA UNIVERSITY

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CERTIFICATE FROM SUPERVISOR

This is to certify that the dissertation work entitled ***"Prevalence of Night Eating Syndrome and Its Interrelationship with Sleep Quality and Psychological Health"***, is submitted by **Ms. Mangalik Hazra** (*Enrolment No.: 2322229002046*) for the partial fulfilment of the degree of Masters of Science in **Applied Nutrition and Dietetics** under Sister Nivedita University. The entire work, which is being presented, has been carried out sincerely and satisfactorily under my supervision and guidance.

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DECLARATION BY THE STUDENT

I hereby declare that the work which is being presented in this dissertation entitled "***Prevalence of Night Eating Syndrome and Its Interrelationship with Sleep Quality and Psychological Health***" in partial fulfilment of the requirements for the award of the degree of Masters of Science in Applied Nutrition and Dietetics is an authentic record of my own work carried out during the period from January 2025 to May 2025 under the supervision of Dr. Moumita Das, Department of Applied Nutrition and Dietetics, Sister Nivedita University

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Abstract

This cross-sectional study examined the prevalence of Night Eating Syndrome (NES) and its associations with sleep quality, psychological factors, and anthropometric measurements among 102 adults aged 20-40 years in suburban Kolkata, India. Using the Night Eating Diagnostic Questionnaire, Pittsburgh Sleep Quality Index, Insomnia Severity Index, and PHQ-4, the study revealed a substantially higher NES prevalence (57.84%) than international reports, with 28.43% meeting full syndrome criteria. Exceptionally strong correlations emerged between NES severity and sleep disturbances (PSQI r=0.816, ISI r=0.815), psychological distress (r=0.572), and anthropometric indices (BMI r=0.259, WHR r=0.298). Age demonstrated significant positive correlation with NES severity (r=0.565), with the fourth decade representing peak vulnerability. Among full syndrome participants, 93.1% experienced significant sleep disturbances and clinically significant anxiety/depression. The findings suggest NES constitutes a complex constellation of sleep, psychological, and metabolic disturbances requiring integrated treatment approaches. This research addresses a critical gap in Indian literature, providing baseline prevalence data and establishing NES as a significant public health concern warranting immediate attention from healthcare providers and policymakers for developing culturally appropriate screening tools and comprehensive intervention strategies.

Keywords: *Night Eating Syndrome, sleep quality, psychological distress, anthropometric measurements, circadian rhythm, nocturnal hyperphagia, insomnia, anxiety, depression, India*

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Chapter 1

Introduction

Night Eating Syndrome (NES) is an eating disorder marked by nocturnal eating episodes, wherein patients ingest a minimum of 25% of their normal calorie intake throughout the evening or night (Kaur et al., 2022; Kim et al., 2023; APA, 2013; O'Reardon et al., 2005; Kazgan Kılıçaslan et al., 2024). Additional distinctive symptoms of this illness encompass diminished morning appetite, conscious awareness throughout eating episodes, as well as varying degrees of insomnia (Kazgan Kılıçaslan et al., 2024; Allison et al., 2010; Birketvedt, 1999; Kaur et al., 2022). In NES, the circadian rhythm of hormone secretion involving appetite and sleep control becomes imbalanced, causing difficulties with sleep onset and appetite regulation (Dias et al., 2023). Individuals affected by NES often experience diminished physiological quality of life alongside stressful living environments, periods of remission and exacerbation, and weight management issues, all of which contribute to these episodes (Vander Wal, 2012; Köse et al., 2024). NES is categorized in the Diagnostic and Statistical Manual of Mental Disorders (DSM) as "Other Specified Feeding or Eating Disorder." (APA, 2013; Gundogdu, 2022). NES prevalence in the general population is typically around 1.1% - 1.5%, with some studies indicating rates up to 5.7% in specific subgroups such as young adolescents, although prevalence varies by demographic (Öner et al., 2018; Marchesini et al., 2010; Pinto et al., 2016).

People with NES frequently exhibit multiple indicators of mental health issues and sleep disorders, like sleep apnea and insomnia, which adversely affect their sleep quality (Sakthivel et al., 2023). Sleep is an essential restorative mechanism for the human body that profoundly impacts overall health and wellness. Consequently, compromised sleep

quality can increase susceptibility to major health conditions and morbidity (Hamurcu, 2022; Vander Wal, 2012; Kazgan Kılıçaslan et al., 2024). Simultaneously, periodic sleep disturbances can exacerbate NES symptoms (Hamurcu, 2022). Like other eating disorders, NES contributes to weight management challenges, as multiple studies indicate that individuals affected by NES demonstrate higher obesity levels, and conversely, obese patients often exhibit signs of NES (Kara et al., 2020; Calugi et al., 2009; Colles et al., 2007; Atik et al., 2019). A study by Palmese et al. (2013) showed that 22% of obese schizophrenic patients displayed some degree of NES, with 12% showing signs of complete NES. Another study by YILMAZ et al. (2024) revealed that 25.6% of participants suffered from night eating syndrome, with obese individuals demonstrating higher prevalence than those who were merely overweight. Eating disorders generally negatively impact psychological well-being, increasing anxiety and depression, especially among young adolescents (Gundogdu, 2022; Olbrich et al., 2009). A recent study from Saudi Arabia, Alrahili et al. (2024) identified significant correlation of eating disorders (EDs) with depression among adolescents, with 93.3% of ED patients experiencing depression. Eating disorders in adolescents impair biopsychosocial functioning and are associated with increased anxiety and depression. Risk factors include bullying, weight-based teasing, and social media exposure, highlighting the significant psychological impact these disorders have on young individuals (Goldstein & Goldstein, 2024; Hamurcu, 2022). Among individuals with NES, studies have documented psychiatric comorbidities including ”major depression” (22%), ”generalized anxiety disorder” (7.8%), ”obsessive-compulsive disorder” (12.5%), and ”panic disorder” (14%), indicating a strong association between NES and psychiatric disorders (KÜÇÜKGÖNCÜ & BEŞTEPE, 2014).

Despite the growing recognition of NES as a significant eating disorder with numerous health implications, research in this field remains limited and unexplored, particularly in the Indian context (Kuppili et al., 2019; Khandelwal et al., 1995; Vaidyanathan & Menon, 2024). Current research in India has primarily concentrated on university students and adolescents, resulting in a notable deficiency in our comprehension of NES across various age demographics and socioeconomic strata. (Gandhi & Battalwar, 2019; Mohamad & Hamirudin, 2023; Murthy et al., 2024). One exception is a study by Pal et al. (2023)

which examined a relatively wider age range of 18-60 years. However, comprehensive studies investigating NES across diverse demographic profiles in India are scarce. This research gap is particularly concerning given the unique cultural, dietary, and lifestyle factors that may influence eating patterns in the Indian population (Vaidyanathan & Menon, 2024). The present study addresses this limitation by targeting adults aged 20-40 years from varied socioeconomic backgrounds, occupations and culture, thereby providing a more representative assessment of NES prevalence and characteristics in the Indian context. This broader demographic approach will contribute valuable insights into how NES manifests across different population segments and potentially identify specific risk factors or patterns unique to the Indian setting. Furthermore, understanding these patterns could inform culturally appropriate intervention strategies that consider the specific needs and circumstances of diverse Indian populations affected by NES.

Chapter 2

Aims & Objectives

This study seeks to fill the notable research void about Night Eating Syndrome (NES) in the Indian context, concentrating on adults aged 20-40 years in suburban areas of Kolkata. This work aims to deliver a thorough evaluation of NES prevalence and its related characteristics among the varied demographic profiles in India, given the little exploration of NES in this context. The major objective is to assess the prevalence of NES and analyze its correlation with sleep quality, psychological variables, and anthropometric parameters in this under-researched demographic bracket.

1. To explore the prevalence of Night Eating Syndrome in the suburban areas of Kolkata among a concentrated sample of people aged 20-40 years, thereby augmenting the scant research on NES within the Indian setting and establishing baseline prevalence statistics for this particular demographic.

2. To examine the correlation between night eating syndrome (NES) and sleep quality metrics, including insomnia severity, and to assess how the intensity of NES relates to different levels of sleep disturbances, thereby elucidating the bidirectional relationship between nocturnal eating habits and sleep disruption.

3. To determine the correlation between NES and psychological factors like anxiety and depression, and examine how these mental health variables influence nocturnal eating patterns and whether the severity of psychological distress correlates with the intensity of NES symptoms.

4. To identify and analyze gender disparities in the prevalence and the severity of Night Eating Syndrome (NES) and its contribution to distinct patterns of nocturnal eating behaviors and related comorbidities.

5. To examine the correlation strengths between NES and various variables, including sleep quality parameters, severity of insomnia, anxiety and depression metrics, and anthropometric indices such as Waist-Hip Ratio and Body Mass Index (BMI), thereby establishing an in-depth comprehension of how these factors interrelate in NES.

Chapter 3

Review of Literature

Night Eating Syndrome (NES), also referred to as ”nocturnal eating syndrome” has been first described as patterns of nocturnal hyperphagia amongst obese patients by (Stunkard et al., 1955). Since then, the definition of the syndrome's characteristics has evolved and undergone multiple refinements over the ensuing decades, leading up in its formal recognition in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as an ”Other Specified Feeding or Eating Disorder” (APA, 2013). According to the current diagnostic criteria, NES is defined by recurrent patterns of night eating, characterized by the ingestion of at least 25% of daily calorie intake post-evening meal or during nocturnal awakenings, with consciousness and recollection of these eating episodes (Allison et al., 2010; O'Reardon et al., 2005). In some cases, patients often struggle to fall asleep unless they have eaten something. NES is frequently confused with binge eating disorder, and while some overlap exists between the conditions, Milano et al. (2011) identified a crucial distinguishing factor: the timing of consumption. Individuals with NES predominantly consume food during nighttime hours in an uncontrollable manner with full mental awareness, whereas those with binge eating disorder may engage in excessive eating episodes at various times throughout the day with differing degrees of perceived control and awareness.

The etiology of Night Eating Syndrome involves complex neurobiological mechanisms rooted in circadian rhythm disruption and hormonal dysregulation. Meléndez-Fernández et al. (2023) found that exposure to artificial light at night (ALAN) disrupts the synchronization of the suprachiasmatic nucleus (SCN) with peripheral clocks in metabolic

tissues, resulting in misalignment of hormone secretion and behavioral patterns. This circadian disruption fundamentally alters the secretion of key metabolic hormones: melatonin production becomes suppressed, reducing sleep initiation capacity; cortisol levels may rise inappropriately at night, promoting alertness and glucose availability; and appetite-regulating hormones leptin and ghrelin become imbalanced, with decreased leptin reducing satiety and elevated ghrelin increasing hunger during biological night hours. These hormonal shifts create a physiological drive to eat at night despite the body's reduced capacity to metabolize food during this period. Concurrently, sleep-regulating neural circuits within the hypothalamus become impaired by circadian misalignment, with reduced activity in sleep-promoting areas and dysregulation in the dorsomedial hypothalamus resulting in poor sleep quality and increased nighttime wakefulness. This creates a self-reinforcing cycle where inadequate sleep increases hunger, and night eating further impairs sleep quality, ultimately generating the hallmark features of NES: delayed circadian phase, nocturnal hyperphagia, and insomnia.

Epidemiological studies on NES have reported varying prevalence rates across different populations. In general population, prevalence estimates typically around 1.1% - 5.7% (Striegel-Moore et al., 2006; Rand et al., 1997), while significantly higher rates between 8.9% and 15% have been documented in populations seeking weight management interventions (Colles et al., 2007; Calugi et al., 2009; Arslan et al., 2015). Lundgren et al. (2006) reported a progressive increase in NES prevalence corresponding with weight status, finding rates of approximately 6% in normal weight individuals, 8% in overweight individuals, and up to 28% in severely obese individuals. Atik et al. (2019) found that 13% of 452 morbidly obese patients awaiting bariatric surgery met criteria for NES, with these patients showing significantly higher rates of psychiatric disorders (44.1% vs. 26.2%) and depression (25.4% vs. 13%) compared to those without NES. A meta-analysis by Gallant et al. (2012) established that persons with NES exhibited a significantly elevated BMI in comparison to those without the syndrome. The relationship appears bidirectional, as longitudinal studies by Marshall et al. (2004) demonstrated that NES predicted future weight gain and obesity development, while (Dalle Grave et al., 2010) found that weight loss treatment was complicated by the presence of NES. The mechanisms linking

NES to weight-related issues include increased total daily caloric intake, consumption of energy-dense comfort foods during night eating episodes, metabolic disruptions due to circadian rhythm misalignment, and reduced physical activity resulting from fatigue associated with poor sleep quality (Goel et al., 2009; Allison et al., 2010; Abo El-Ela et al., 2022). Assessing this link is essential for formulating effective interventions targeting both nocturnal eating practices and weight management measures.

The cardiovascular implications of Night Eating Syndrome extend beyond weight management concerns, with emerging evidence suggesting direct pathophysiological links between circadian misalignment and cardiometabolic risk factors. In a controlled laboratory study, Scheer et al. (2009) demonstrated that circadian misalignment—characterized by participants eating and sleeping approximately 12 hours out of phase with their habitual schedules—systematically decreased leptin levels by 17%, increased glucose levels by 6% despite elevated insulin levels, completely reversed daily cortisol rhythms, raised mean arterial pressure by 3%, and reduced sleep efficiency by 20%. This misalignment resulted in three of eight subjects displaying postprandial glucose levels within the prediabetic range, highlighting the significant metabolic repercussions of altered food and sleep schedules. These findings offer essential mechanistic understanding of how the circadian rhythm disruption associated with NES may elevate the risk of cardiovascular disease, insulin resistance, and metabolic dysfunction. The research demonstrates that the food intake timing and sleep, independent of food composition or total caloric intake, has significant physiological consequences that may explain the elevated health risks observed in individuals with NES, particularly regarding hypertension and metabolic syndrome development.

The relationship of Night Eating Syndrome (NES) with sleep disturbances has been well-established in the literature. Sleep is a vital regenerative process for the human body, which significantly influences the overall health and wellness. Compromised sleep quality can increase susceptibility to major health conditions (Hamurcu, 2022; Vander Wal, 2012). In the study of obese patients seeking primary healthcare, Abo El-Ela et al. (2022) found that insomnia symptoms were significantly more prevalent among those with NES ($p=0.017$). This finding aligns with research by Birketvedt (1999), who documented

disrupted sleep architecture and frequent nocturnal awakenings in NES patients. Similarly, a study by KÜÇÜKGÖNCÜ and BEŞTEPE (2014) revealed that 47.4% of night eaters exhibited lifetime anxiety disorders and significant sleep disruptions compared to healthy controls (9.1%), while, a study by Kazgan Kılıçaslan et al. (2024) examining psychiatric outpatients found a significant positive correlation between night eating behaviors and poor sleep quality, with sleep problems directly predicting night eating syndrome. The underlying mechanisms involve dysregulation of neuroendocrine functions controlling both sleep-wake cycles and appetite regulation, particularly involving serotonin, melatonin, leptin, and cortisol rhythms (Mohamad & Hamirudin, 2023; Goel et al., 2009; O'Reardon et al., 2005). These hormonal imbalances contribute to both the delayed food intake pattern and sleep disturbances characteristic of NES. A Swedish study found that total night eating scores were strongly correlated with sleep disorders (Lundgren et al., 2006), while research by Cerú-Björk et al. (2001) demonstrated that nocturnal eating episodes were consistently preceded by sleep disturbances. The complex relationship between disordered eating and disturbed sleep underscores the necessity of treating both factors in treatment strategies.

Another significant association of Night Eating Syndrome (NES) is along with psychological distress, particularly depression and anxiety, has been consistently documented across numerous studies. Research by Orhan et al. (2011) indicated that the prevalence of NES was markedly elevated in patients with serious depression (35.2%) relative to healthy controls (19.2%), implying that individuals with depression are 2.64 times more predisposed to acquire NES. Their study also identified depression as a significant independent predictor of NES alongside male gender and higher BMI. Similarly, KÜÇÜKGÖNCÜ and BEŞTEPE (2014) reported a 15.7% prevalence of NES among psychiatric outpatients, with the highest rates shown among patients of major depression (22%) compared to those with anxiety disorders. They documented notable psychiatric comorbidities including major depression (22%), generalized anxiety disorder (7.8%), obsessive-compulsive disorder (12.5%), and panic disorder (14%). This high comorbidity may reflect underlying neurobiological mechanisms, as both NES and mood disorders share dysregulation in serotonergic pathways, as evidenced by Birketvedt (1999), where elevated cortisol levels among night eaters between 8:00 AM and 2:00 AM were identified in comparison to

controls. Research by Gundogdu and Yildirim (2023) on adolescents demonstrated that sleep problems influenced NES in both active and passive forms through depression and stress pathways. The therapeutic implications underscore the necessity of treating both eating behaviors and underlying psychological aspects in treatment strategies, as stated by Vander Wal (2012). Furthermore, evidence from KÜÇÜKGÖNCÜ and BEŞTEPE (2014) suggests psychological factors may both precipitate and perpetuate night eating behaviors, with NES patients showing significantly higher rates of suicide attempts (36.2% vs. 20.9%), creating what Lundgren et al. (2006) described as a self-perpetuating cycle where emotional distress triggers night eating, which disrupts sleep, further exacerbating psychological symptoms. This pattern corresponds with data indicating that persons with NES frequently employ midnight eating as a maladaptive coping mechanism to manage negative feelings.

The relationship between Night Eating Syndrome and psychological factors appears to be particularly pronounced during specific developmental periods, with adolescence and emerging adulthood representing critical windows of vulnerability. Gundogdu and Yildirim (2023) investigated 167 adolescents aged 12 to 18 years and discovered that heightened stress, exacerbated depressive symptoms, challenges in initiating sleep, and daytime somnolence exhibited strong correlations with NES. Their research uncovered gender-specific trends, indicating that teenage females exhibited elevated stress and sadness scores linked to NES, whereas adolescent boys demonstrated increased depression scores and sleep difficulties connected with NES. The study demonstrated that sleep disturbances and associated issues influenced night eating by depression and stress pathways, suggesting that addressing sleep difficulties and psychological distress may be crucial for treating NES in adolescents. This developmental perspective is further supported by research indicating that the adolescence transition represents a particularly vulnerable period for developmental of mental disorders like NES. Potterton et al. (2020) conducted a systematic scoping review highlighting that emerging adulthood, i.e. young adults (approximately 18-25 years) presents unique challenges for individuals with eating disorders, including NES, as this life phase involves identity exploration, educational transitions, and changing social environments that may exacerbate nocturnal eating behaviors and complicate treatment ap-

proaches. Studies investigating Night Eating Syndrome within particular professional and demographic cohorts have uncovered significant differences in prevalence and related risk variables. In a Brazilian sample of 900 university students from Architecture, Engineering, Medicine, and Psychology courses, Dias et al. (2023) identified a 16.8% prevalence of Night Eating Syndrome (NES), revealing notable gender-specific patterns across various academic disciplines: Engineering courses showed higher NES prevalence in women than men, while Psychology courses demonstrated the opposite pattern.The research discovered two significant risk scenarios: enrollment in undergraduate courses predominantly attended by the opposite sex, and cohabitation with parents while undertaking afternoon shifts. Similarly, among working populations, Anthonisamy et al. (2022) documented that 12.0% of inbound call center employees had NES in Kuala Lumpur, Malaysia, with significant associations found between NES and ”adequate exercise patterns” (AOR = 4.250) and ”emotional eating behaviors” (AOR = 6.510). These occupational studies underscore how particular work environments, academic demands, and lifestyle factors inherent to various populations may engender unique susceptibilities to nocturnal eating patterns, indicating that intervention strategies ought to be customized to mitigate the specific stressors and conditions pertinent to each demographic group.

Studies examining Night Eating Syndrome in clinical populations have provided valuable insights into the syndrome’s manifestation among individuals with pre-existing medical conditions. Almuammar et al. (2024) investigated NES among 154 bariatric surgery patients in Saudi Arabia, finding a substantial prevalence of 33.8% meeting NES criteria post-surgery. The study indicated that NES was markedly more common in female patients (42.2%) than in male patients (23.9%), and highlighted chronic illnesses, especially diabetes, as important risk factors for the onset of NES post-bariatric surgery. Similar findings had been reported in a research by Arslan et al. (2015), who examined 158 ”overweight” or ”obese patients” with serious mental illness and found NES prevalence rates of 7.6% via clinical interview and 16.5% using questionnaire-based assessment. Lundgren et al. (2010) further substantiated these findings in their study of 68 overweight and obese patients with severe mental illness, indicating that 25.0% satisfied the criteria for Night Eating Syndrome (NES) using conservative standards, which is markedly higher than

rates observed in general population studies. Although marital status is generally linked to improved health outcomes, as evidenced by Robles et al. (2014) in their meta-analysis of 126 studies indicating that higher marital quality correlates with enhanced health outcomes, including reduced mortality risk, the association between marital status and eating disorders may be more intricate, possibly involving factors such as communal eating habits, familial stress, or age-related confounding variables that require further examination. Both studies demonstrated that NES in clinical populations is linked with compromised quality of life and increased sleep disturbances, suggesting that individuals with pre-existing medical or psychiatric conditions are possibly at an elevated risk of developing nocturnal eating patterns. The high prevalence rates observed in these clinical samples compared to general population studies underscore the importance of screening for NES in healthcare settings, particularly among patients undergoing weight management interventions or those with chronic medical conditions that may predispose them to circadian rhythm disruptions.

Research on Night Eating Syndrome (NES) demonstrates varying prevalence and significant health associations across different populations. Yahia et al. (2017) found only 1.2% of college students met full-syndrome NES criteria, with additional participants showing mild to moderate night eating behaviors. Their cross-sectional research indicated no significant disparities in BMI, dietary habits, physical activity, or smoking status between individuals with and without NES symptoms. Nonetheless, NES was markedly correlated with diminished sleep length ($p=0.023$) and inferior sleep quality, as evidenced by impacted students achieving higher scores on the Pittsburgh Sleep Quality Index (6.73 ± 4.06 vs. 5.61 ± 2.61, $p=0.007$). Complementing these findings, review by Sakthivel et al. (2023) of 30 studies revealed inconsistent but notable associations between NES and elevated BMI, reduced physical activity, type 2 diabetes mellitus, and compromised sleep quality. Their analysis found no consistent associations between NES and hypertension, obstructive sleep apnea, or metabolic syndrome, though sample sizes examining these conditions were small. The inconsistencies were ascribed to methodological variations, insufficient statistical power due to small sample size, and demographic disparities among research, with more robust relationships often observed in higher-quality, representative populations compared to university samples.

The academic implications of Night Eating Syndrome extend beyond general performance metrics to encompass specific cognitive and behavioral domains that affect learning outcomes. A comprehensive study by AHMAD et al. (2019) involving 241 university students revealed that 35.7% exhibited mild NES, 13.3% moderate NES, and 9.5% full syndrome, demonstrating a strong inverse correlation between NES severity and academic grade point average (GPA). The research showed that each unit increase in NES severity was associated with decrease in GPA, with an odds ratio of 2.19, indicating that students with NES were extremely likely to experience academic difficulties. It also revealed that increased body mass index was significantly associated with NES development, creating a complex interplay between eating patterns, weight status, and academic achievement. These findings complement research by Farhangi (2019), who examined 80 adolescent boys and showed that those with NES demonstrated poorer sleep quality along with higher fat intake, and altered nutritional patterns characterized by lower carbohydrate and higher fat consumption. Among working populations, similar patterns emerge as demonstrated by Murthy et al. (2024), who found a 37.3% prevalence of NES among college students in Tamil Nadu, India, with significant associations between NES and depression ($p<0.001$) and BMI ($p<0.001$). The relationship of NES and academic performance appears to be mediated through multiple pathways, including sleep disruption, altered cognitive function due to circadian misalignment, and potentially through nutritional factors that affect brain function and learning capacity, highlighting the multifaceted impact of nocturnal eating behaviors on educational outcomes.

Despite the growing recognition of NES as a significant eating disorder with numerous health implications, research in this field remains limited, particularly in the Indian context (Kuppili et al., 2019; Khandelwal et al., 1995; Vaidyanathan & Menon, 2024). The following studies represent significant contributions to our understanding of NES and its correlates.

Fischer et al. (2012) investigated NES in a cohort of 1,514 young adults aged 18 to 26 from the general population. The authors identified a prevalence rate of 1.3% utilizing questionnaire-based DSM-IV criteria and observed only a slight overlap between Night Eating Syndrome and both Binge Eating Disorder and Bulimia Nervosa. Their

findings revealed that patients with NES exhibited more severe eating disorder pathology and heightened levels of general psychopathology, especially depressive symptoms and social stress. It also demonstrated that NES is associated with considerable distress-related symptoms and problems in daily functioning. This research was among the first to establish NES as a distinct clinical entity in non-clinical populations, providing evidence for its inclusion as a separate diagnostic category and highlighting the need for specific treatment approaches targeted at the unique symptom profile of NES.

Kim et al. (2023) investigated the association between NES and health-related quality of life (HRQoL) through a nationwide Korean study involving 34,434 adults. Using Night Eating Questionnaire and the 3-level EuroQoL-5 Dimension Index, they found that participants with NES (β=−4.85, p<0.001) reported significantly poor HRQoL scores than those without NES. The study highlighted the complex interrelationship between eating patterns, sleep duration, and quality of life, suggesting that NES has a substantial negative impact on overall wellbeing that may be exacerbated by sleep disturbances, a finding particularly relevant to the present study's investigation of these interconnected factors.

Adding to this body of research, Hamurcu (2022) performed a cross-sectional study investigating the correlations among night eating syndrome, sleep quality, and quality of life in a sample of 846 Turkish university students. Using standardized assessment tools including the Night Eating Questionnaire, Pittsburgh Sleep Quality Index, and WHOQOL-BREF-TR, the author reported a strikingly higher prevalence of NES risk (67.7%) and eating disorders risk (38.4%) than most studies. All participants demonstrated poor sleep quality, and those with NES risk showed significantly lower scores across all quality of life dimensions (p<0.001). Statistical analysis revealed significant negative correlations between sleep quality scores and various dimensions of quality of life. These findings underscore the bidirectional relationship where poor sleep quality may increase vulnerability to NES, which in turn further compromises sleep and overall quality of life. This study is particularly germane to the current research as it focused specifically on young adults in an academic setting and comprehensively examined the same key variables being investigated in the present study.

Chapter 4

Methodology

This study utilized a cross-sectional research methodology to investigate the prevalence of Night Eating Syndrome (NES) and its correlation with sleep quality, psychological factors, and anthropometric measurements among persons aged 20-40 years living in suburban areas of Kolkata, India. A cross-sectional design was deemed appropriate as it allows for the assessment of prevalence and associations at a specific point in time, providing valuable baseline data in this understudied population.

Study Population and Sampling

The study recruited a total of 102 participants from suburban regions of Kolkata. The target population comprised adults aged 20-40 years from diverse socioeconomic backgrounds and occupational categories. The sample primarily consisted of students pursuing bachelor's and master's degrees at Sister Nivedita University and teaching faculty from the same institution. To enhance demographic diversity, the study also included residents from nearby suburban areas of Kolkata representing various professional backgrounds, including housewives, small business owners, service professionals, and salaried employees. Participant selection followed specific inclusion criteria designed to ensure data quality and reliability. All participants were required to be healthy people aged 20 to 40 years, devoid of significant health issues or severe illnesses that could distort eating behaviors. Participants required adequate linguistic competence to understand and answer surveys conducted in English. In instances of linguistic barriers, the questionnaire was translated live into Bengali or Hindi. Informed consent was acquired from all subjects before data

collection commenced.

The study excluded pregnant women from the sample, as pregnancy-related hormonal changes naturally alter eating patterns and cravings, which could be misinterpreted as disordered eating behaviors (Fairburn et al., 1992). This exclusion criterion strengthened the internal validity of the findings by minimizing potential confounding variables. Data collection was conducted through face-to-face surveys, allowing researchers to clarify questions, translate them and ensure complete responses while establishing rapport with participants. This approach yielded high-quality data with minimal missing values, despite the sample size being smaller than initially projected. While the final sample of 102 *(N)* participants is relatively small than other studies, it provided sufficient statistical power to address the primary research objectives while accounting for the exploratory nature of NES research in this context.

Data Collection Tools

Anthropometric Measurement

Anthropometric measures were obtained from all participants in accordance with standardized protocols outlined in the Anthropometry Procedures Manual (2021). Participants were directed to don lightweight attire to ensure precise evaluation of body composition metrics, including weight, height, waist circumference, and hip circumference.

Height was assessed with individuals standing barefoot, employing a calibrated anthropometric rod, with measurements documented to the nearest 0.1 cm. Proper positioning had been ensured with participants standing erect, arms hanging naturally at the sides, heels together, and head positioned in the anthropometric rod. Weight measurements were obtained using a weight scale, with participants instructed to remove shoes and heavy clothing. Participants were positioned upright at the center of the weighing platform, gazing forward with weight uniformly distributed on both feet, and measurements were documented to the nearest 0.1 kg. Waist and hip circumferences were assessed utilizing a non-elastic measuring tape in accordance with World Health Organization protocols. Waist circumference was assessed at the midpoint of the inferior edge of the last palpable rib and the superior border of the iliac crest, with the measuring tape horizontally aligned around

the abdomen at the conclusion of a normal expiration. Hip circumference was assessed at the broadest part of the buttocks, with the measuring tape aligned horizontally. Both measurements were documented to the closest 0.1 cm.

From these direct measurements, two key derived indices were calculated.The Body Mass Index (BMI) was calculated using the standard formula: weight (kg) divided by height squared (m). Participants were subsequently categorized based on the criteria established by the World Health Organization and the Centers for Disease Control and Prevention (CDC).: underweight (BMI $< 18.5\ kg/m$), normal weight (BMI 18.5-24.9 kg/m), overweight (BMI 25.0-29.9 kg/m), and obese (BMI $\geq 30.0\ kg/m$). For more nuanced analysis, obesity was further sub-classified into Class I (BMI 30.0-34.9 kg/m), Class II (BMI 35.0-39.9 kg/m), and Class III (BMI $\geq 40.0\ kg/m$). The waist-to-hip ratio (WHR) is determined by dividing the circumference of the waist by the circumference of the hips. This metric offers significant insights into body fat distribution, especially central adiposity, which is closely linked to cardiometabolic risk. Participants were classified based on health risk levels: low health risk (WHR < 0.9), moderate health risk (WHR 0.9-1.0), and high health risk (WHR > 1.0). These clinically significant thresholds indicate the recognized correlation between central obesity and heightened risk for cardiovascular disease, type 2 diabetes, and several metabolic diseases.

All anthropometric measures were performed by trained researchers utilizing the same calibrated equipment throughout the trial to reduce measurement error and ensure data dependability. Each measurement was conducted twice, and the mean result was utilized for analysis to improve accuracy.

Night Eating Diagnostic Questionnaire

The Night Eating Diagnostic Questionnaire (NEDQ) was employed as the primary instrument for assessing Night Eating Syndrome. This comprehensive 21-item assessment tool primarily utilizes a yes/no response format and systematically evaluates each criterion proposed for NES diagnosis (Geliebter, 2017). The questionnaire thoroughly examines essential diagnostic indicators including morning appetite patterns, timing of first daily food intake, evening and nocturnal eating behaviors, post-dinner food consumption rates, and etc. The NEDQ represents an evolution in NES assessment methodology. Originally

developed by Allison et al. (2008)) based on work by Stunkard et al. (1955), the instrument underwent significant refinement to integrate the revised diagnostic criteria Allison et al. (2010). This adjustment improved the questionnaire's diagnostic accuracy and clinical applicability. The diagnostic criteria evaluated by the NEDQ and the hierarchical scoring technique are outlined in Table 4.1.

Table 4.1: Proposed Diagnostic Criteria evaluated by the NEDQ

I	The daily pattern of eating demonstrates a significantly increased intake in the evening and/or nighttime, as manifested by one or both of the following: A. At least 25% of food intake is consumed after the evening meal. B. At least two episodes of nocturnal eating per week.
II	Awareness and recall of evening and nocturnal eating episodes are present.
III	The clinical picture is characterized by at least 3 of the following features: A. Lack of desire to eat in the morning and/or breakfast is omitted on four or more mornings per week B. Presence of a strong urge to eat between dinner and sleep onset and/or during the night C. Sleep onset and/or sleep maintenance insomnia are present four or more nights per week D. Presence of a belief that one must eat in order to initiate or return to sleep E. Mood is frequently and/or mood worsens in the evening
IV	The disorder is associated with significant distress and/or impairment in functioning.
V	The disordered pattern of eating has been maintained for a minimum of 3 months.
	Standard Scoring Based on Above Criteria
Dichotomous (not used)	
0	**Non-NE** = *normal* (does not meet criteria category above)
1	**NES** = *full syndrome night eater* has 1 criterion from I **plus** $\geq$ 3 of 5 qualifiers from criteria III **plus** IV and V
Experimental Hierarchical Scoring (used)	
0	**Non-NE** = *normal* (does not meet criteria category above)
1	**N** = *mild night eater* has 1 criteria from I (but does not meet criteria NE or NES)
2	**NE** = *moderate night eater* has 1 criteria from I **plus** $\geq$ 3 of 5 qualifiers from criteria III (but does not meet criteria NES)
3	**NES** = *full syndrome night eater* has $\geq$ 1 from I **plus** $\geq$ 3 of 5 qualifiers from criteria III **plus** IV and V

Traditional internal consistency measures are inapplicable to the NEDQ, as it serves largely as a symptom checklist rather than a scale assessing a unidimensional entity. However, the instrument demonstrates strong convergent validity with the Night Eating Questionnaire (NEQ), as established by Geliebter (2017), confirming its diagnostic

accuracy. The NEDQ has been successfully implemented across diverse populations internationally. For instance, AHMAD et al. (2019) utilized the instrument in their research with Turkish university students, identifying NES in 9.5% of participants based on NEDQ criteria. This demonstrates the tool's cross-cultural applicability and sensitivity to NES symptoms across different demographic groups. For the present study, we specifically selected the hierarchical scoring method for the NEDQ. This methodological decision was motivated by two primary considerations: first, the hierarchical scoring approach remains significantly underexplored in the research literature, particularly in non-Western populations; and second, this scoring method captures subtle variations across multiple anthropometric measures and psychometric scales, allowing for more nuanced analysis of NES manifestation within our study population. This approach aligns with our research objectives to comprehensively examine NES and its multifaceted associations in the Indian context.

Pittsburgh Sleep Quality Index

This study employed the Pittsburgh Sleep Quality Index (PSQI), an established and widely recognized tool, to comprehensively assess participants' sleep quality (Buysse et al., 1989; Shahid et al., 2011). The PSQI is a standardized self-administered questionnaire including 24 items, including 19 self-rated questions and 5 items intended for completion by a roommate or bed partner, which are excluded from the scoring process. The PSQI assesses seven components of sleep quality of the period of preceding month: 'subjective sleep quality', 'sleep latency', 'sleep duration', 'habitual sleep efficiency', 'sleep disruptions', 'utilization of sleep drugs', and 'daily dysfunction resulting from drowsiness'. Each component is evaluated on a scale from 0 to 3, with elevated scores signifying increased sleep difficulties in that specific domain. The component values are aggregated to provide a global PSQI score that ranges from 0 to 21, with 0 signifying no sleep difficulties and 21 denoting significant sleep issues across many aspects.

For more nuanced analysis in this cross-sectional study, we categorized the global PSQI scores into four distinct levels of sleep quality (Zheng et al., 2021): Good Sleep Quality (0-5), Average Sleep Quality (6-10), Poor Sleep Quality (11-15), Very Poor Sleep Quality (16-21). This enhanced categorization facilitated a more nuanced analysis of the

correlation between different levels of sleep quality and nocturnal eating patterns, offering superior analytical accuracy compared to the conventional binary classification of excellent versus bad sleep quality. The PSQI demonstrates good psychometric properties, evidenced by high internal consistency (Cronbach $\alpha = 0.83$), robust test-retest reliability, and validity across diverse populations, rendering it particularly appropriate for this study's aim of elucidating potential correlations between sleep parameters and Night Eating Syndrome (Fabbri et al., 2021).

Insomnia Severity Index

The Insomnia Severity Index (ISI) was employed to evaluate the type, severity, and impact of insomnia among participants. This validated 7-item self-report questionnaire employs a Likert-type scale to evaluate multiple aspects of sleep disturbance, encompassing perceived severity of sleep onset and maintenance issues, satisfaction with current sleep patterns, interference with daily functioning, visibility of impairment, and distress resulting from sleep problems (Bastien et al., 2001; Shahid et al., 2011). Total scores range from 0 to 28, with defined clinical thresholds classifying responders into four categories: no clinically significant insomnia (0-7), subthreshold insomnia (8-14), moderate clinical insomnia (15-21), and severe clinical insomnia (22-28). The ISI exhibits strong psychometric qualities across several populations, demonstrating great internal consistency with a Cronbach's alpha of 0.84 among Indian university students (Veqar & Hussain, 2017) and 0.90-0.91 in community and clinical samples (Castronovo et al., 2016; Morin et al., 2011). Its strong convergent validity with sleep diaries and other objective sleep measures makes it particularly valuable for assessing insomnia symptoms in research and clinical settings.

PHQ-4 (Anxiety and Depression)

To evaluate anxiety and depressive symptoms among participants, this study employed the Patient Health Questionnaire-4 (PHQ-4) developed by Kroenke et al. (2009). This short yet effective screening instrument has four items: two questions sourced from the PHQ-2 evaluating depressed symptoms and two questions from the Generalized Anxiety Disorder Scale (GAD-2) assessing anxiety symptoms. Responses were evaluated using a 4-point Likert scale, with values from 0 (not at all) to 3 (almost every day), resulting in total

scores between 0 and 12. The PHQ-4 scores were categorized according to established clinical thresholds: Normal (0-2), Mild (3-5), Moderate (6-8), and Severe (9-12). This instrument was specifically selected based on its ability to efficiently assess both anxiety and depression simultaneously, acknowledging the well-documented comorbidity between these conditions (Kroenke et al., 2009). The PHQ-4 has undergone rigorous validation across many ethnic and clinical populations, exhibiting outstanding psychometric qualities. Studies by Caro-Fuentes and Sanabria-Mazo (2023) and Sanabria-Mazo et al. (2023) have validated its robust measurement invariance and factorial configuration. The instrument demonstrates superior internal consistency, evidenced by a Cronbach's alpha of 0.85, rendering it especially appropriate for epidemiological research that require conciseness without compromising reliability. Additionally, its simplicity facilitated administration in this community-based setting while minimizing participant burden.

Statistical Analysis

Statistical analyses were conducted in IBM SPSS Software (version 26.0, IBM Corp., Armonk, NY, USA). All statistical tests were conducted with a predetermined significance level of $\alpha = 0.05$, allowing for consistent interpretation of results across different analyses.

The analytical approach was tailored to the nature of the variables being examined. For categorical data, descriptive statistics including frequencies and percentages were calculated across different severity levels of Night Eating Syndrome as categorized by the Night Eating Diagnostic Questionnaire (NEDQ). To determine statistical significance between categorical variables, Chi-Square tests were employed as these are specifically designed to evaluate associations between nominal variables while accounting for expected frequencies in contingency tables. Mann-Whitney U tests were performed on continuous variables following an analysis of the data's distribution features. This approach was selected over parametric alternatives because it makes no assumptions about the normality of data distribution and is robust against outliers, which were potential concerns in our dataset. Pearson correlation coefficients were computed to evaluate the degree and direction of connections between NEDQ scores and other continuous variables, including sleep quality ratings, anxiety and depression measurements, and anthropometric indices. The correlation studies provide significant insights into the potential relationships between

nocturnal eating practices and other psychological and physiological aspects.

When examining specific subgroups or conducting more complex analyses, appropriate statistical methods were applied with careful consideration of data characteristics and sample size limitations. Throughout the analysis process, efforts were made to ensure methodological rigor while acknowledging the exploratory nature of this research in the Indian context.

Chapter 5

Results

This study examined the prevalence of Night Eating Syndrome (NES) in a cross-sectional sample and analyzed its associations with sociodemographic characteristics, anthropometric measurements, sleep quality, and psychological factors. The analysis included 102 participants (N=102) with a mean age of 29.57 ± 7.12 years. As shown in Table 5.1, 42.16% of participants exhibited no symptoms of NES, while among those with positive NES diagnosis, 15.69% presented with mild syndrome, 13.73% with moderate syndrome, and 28.43% with full syndrome of NES.

Table 5.1: Overall Categorical Night Eating Syndrome prevalence in participants*

Parameters	Normal	Mild	Moderate	Full Syndrome	Total
N	43	16	14	29	102
Percentage	42.16%	15.69%	13.73%	28.43%	100.00%

*Categories as described in **NEDQ**.

Table 5.2 presents the sociodemographic characteristics of participants across varying levels of NES. A significant linear progression was observed in mean age as NES severity increased: participants with no NES symptoms averaged 25.14 ± 5.72 years, while those with full syndrome averaged 34.72 ± 4.04 years, with mild and moderate categories showing progressive increases between these values. Among participants with full syndrome NES, the 31-35 age group was most prevalent, representing 44.8% of cases in this category. In the moderate syndrome classification, 50.0% of participants belonged to the 36-40 age group. Conversely, the majority of participants without NES (67.4%) were from the youngest age group (20-25 years). Correlation analysis revealed a strong positive relationship between age and NES severity ($r = 0.565$, $p < 0.001$), as shown in Table 5.3.

Table 5.2: Sociodemographic Characteristics of Participants by Night Eating Syndrome (NEDQ)

Parameter	Night Eating Syndrome Severity (NEDQ)				Total	*p*-value
	Normal	*Mild*	*Moderate*	*Full Syndrome*		
Age[1] *(Mean ± SD)*	25.14 ± 5.72	30.25 ± 6.98	30.71 ± 8.22	34.72 ± 4.04	29.57 ± 7.12	
20–25	29 (67.4%)	5 (31.3%)	5 (35.7%)	1 (3.4%)	40 (39.2%)	<0.001
26–30	5 (11.6%)	3 (18.8%)	1 (7.1%)	3 (10.3%)	12 (11.8%)	
31–35	6 (14.0%)	3 (18.8%)	1 (7.1%)	13 (44.8%)	23 (22.5%)	
36–40	3 (7.0%)	5 (31.3%)	7 (50.0%)	12 (41.4%)	27 (26.5%)	
Gender						
Male	11 (25.6%)	5 (31.3%)	2 (14.3%)	9 (31.0%)	27 (26.5%)	>0.05
Female	32 (74.4%)	11 (68.8%)	12 (85.7%)	20 (69.0%)	75 (73.5%)	
Education Level						
Less than High School	0 (0.0%)	1 (6.3%)	0 (0.0%)	0 (0.0%)	1 (1.0%)	<0.001
High School	1 (2.3%)	1 (6.3%)	6 (42.9%)	18 (62.1%)	26 (25.5%)	
Bachelor	15 (34.9%)	3 (18.8%)	6 (42.9%)	7 (24.1%)	31 (30.4%)	
Masters	22 (51.2%)	5 (31.3%)	2 (14.3%)	4 (13.8%)	33 (32.4%)	
Doctorate	5 (11.6%)	6 (37.5%)	0 (0.0%)	0 (0.0%)	11 (10.8%)	
Marital Status						
Married	8 (18.6%)	7 (43.8%)	9 (64.3%)	23 (79.3%)	47 (46.1%)	<0.001
Single	35 (81.4%)	8 (50.0%)	5 (35.7%)	6 (20.7%)	54 (52.9%)	
Widowed	0 (0.0%)	1 (6.3%)	0 (0.0%)	0 (0.0%)	1 (1.0%)	
Blood Pressure						
Normal	38 (88.4%)	13 (81.3%)	7 (50.0%)	15 (51.7%)	73 (71.6%)	<0.05
Pre Hypertension	5 (11.6%)	3 (18.8%)	5 (35.7%)	11 (37.9%)	24 (23.5%)	
Stage I Hypertension	0 (0.0%)	0 (0.0%)	2 (14.3%)	3 (10.3%)	5 (4.9%)	
Family History						
Hypertension						
Absent	20 (46.5%)	7 (43.8%)	1 (7.1%)	6 (20.7%)	34 (33.3%)	<0.05
Present	23 (53.5%)	9 (56.3%)	13 (92.9%)	23 (79.3%)	68 (66.7%)	
Obesity						
Absent	27 (62.8%)	10 (62.5%)	3 (21.4%)	11 (37.9%)	51 (50.0%)	<0.05
Present	16 (37.2%)	6 (37.5%)	11 (78.6%)	18 (62.1%)	51 (50.0%)	
Diabetes						
Absent	21 (48.8%)	6 (37.5%)	3 (21.4%)	8 (27.6%)	38 (37.3%)	>0.05
Present	22 (51.2%)	10 (62.5%)	11 (78.6%)	21 (72.4%)	64 (62.7%)	
Lifestyle Factors						
Smoking Status						
Absent	42 (97.7%)	15 (93.8%)	9 (64.3%)	24 (82.8%)	90 (88.2%)	<0.05
Present	1 (2.3%)	1 (6.3%)	5 (35.7%)	5 (17.2%)	12 (11.8%)	
Drinking Status						
Absent	41 (95.3%)	15 (93.8%)	12 (85.7%)	29 (100.0%)	97 (95.1%)	>0.05
Present	2 (4.7%)	1 (6.3%)	2 (14.3%)	0 (0.0%)	5 (4.9%)	

SD = Standard Deviation.[1]For **Age**, the *p*-value is calculated only through Mann-Whitney U Test.

Continuous Variables is presented as both Mean ± SD and through categorical grouping as N (%).

Categorical Variables is presented as N (%).

Gender-based analysis revealed no significant differences in NES prevalence ($p > 0.05$). Despite women comprising the majority of study participants (73.5% of total sample), the gender distribution across NES categories remained proportionally consistent with the overall sample composition. Even in the moderate syndrome category, where women represented 85.7% of cases, this proportion did not differ significantly from the overall female representation in the study as shown in Table 5.2.

Table 5.3: Correlation Chart between Night Eating Syndrome (NEDQ) & Sociodemographic Characteristics

	NES	**Age**	**Smoking Status**	**Drinking Status**	**Family History *(Hypertension)***	**Family History *(Obesity)***	**Family History *(Diabetes)***
NES	–						
Age	0.565	–					
Smoking Status	0.149	0.172	–				
Drinking Status	0.034	- 0.040	0.181	–			
Family History *(Hypertension)*	0.273	0.139	- 0.004	0.099	–		
Family History *(Obesity)*	0.255	0.191	0.046	0.146	0.707	–	
Family History *(Diabetes)*	0.204	0.173	0.141	0.109	0.574	0.771	–

Educational qualification showed statistically significant variation across NES categories ($p < 0.001$). Within the moderate syndrome group, participants with bachelor's degrees and high school education were equally represented (42.9% each). Among those with full syndrome NES, 24.1% had completed bachelor's degrees while 62.1% had attained high school education at most. Participants with doctorate and master's degrees were predominantly represented in the normal and mild syndrome categories. Marital status also demonstrated significant variation across NES categories ($p < 0.001$), with married individuals showing higher prevalence of severe NES: 79.3% of full syndrome and 64.3% of moderate syndrome participants were married. Conversely, single/unmarried individuals predominantly exhibited lower levels of NES, with 81.5% of those without NES being unmarried.

Hypertension status, in terms of Blood Pressure, showed significant association with NES severity ($p < 0.05$). Pre-hypertensive participants comprised 37.9% of full syndrome cases and 35.7% of moderate syndrome cases, while 88.4% of normotensive

individuals exhibited no NES. Despite this association, more than 50% of participants across all NES categories had normal blood pressure. Family history of hypertension demonstrated a significant positive correlation with NES severity ($p < 0.05$, $r = 0.273$), with 79.3% of full syndrome participants and 56.3% of mild syndrome participants reporting hypertension in their family history (Table ref). Similarly, family history of obesity showed a moderate positive correlation with NES ($p < 0.05$, $r = 0.255$). However, family history of diabetes showed no significant association with NES ($p > 0.05$, $r = 0.204$), maintaining consistent proportions across all NES categories. Regarding lifestyle factors, smoking status demonstrated a moderate positive correlation with NES with strong statistical significance ($p < 0.05$, $r = 0.163$), with smokers constituting over 50% of participants in each NES category as detailed in Table ref. In contrast, alcohol consumption showed no significant association with NES ($p > 0.05$, $r = 0.034$).

Beyond lifestyle factors, examination on how body composition anthropometrics corresponded with NES severity, revealed compelling patterns across the participant cohort. Table 5.4 presents these associations between NES and anthropometric measurements, alongside sleep quality, insomnia severity, and psychological evaluations. Anthropometric indices, including BMI and Waist-Hip Ratio, showed highly significant relationships with NES severity. BMI demonstrated a strong positive correlation with NES, with mean values progressively increasing across severity categories: 24.96 ± 3.93 for no NES (Normal), 24.88 ± 4.99 for mild syndrome, 27.03 ± 3.83 for moderate syndrome, and 27.63 ± 5.22 for full syndrome ($p < 0.05$, $r = 0.259$). The proportion of participants classified as overweight increased from 30.2% among those without NES to 44.8% among those with full syndrome. Similarly, Class I obesity prevalence rose from 11.6% in the no NES group to 20.7% in the full syndrome group, while the percentage of participants with normal BMI decreased significantly as NES severity increased. Waist-Hip Ratio also exhibited strong significance and positive correlation with NES severity ($p < 0.05$, $r = 0.298$), with mean WHR values ranging from optimal levels (0.92 ± 0.06) in participants without NES to 0.96 ± 0.08 in those with full syndrome. Notably, the proportion of participants categorized as having high health risk based on WHR was substantial across all NES categories, ranging from 43.8% among those without NES to 100% in the moderate syndrome group, while only

23.3% of participants without NES fell into the lower health risk category.

Table 5.4: Association of Sleep Quality, Insomnia Severity, Psychological and Anthropometric Characteristics of Participants with Night Eating Syndrome (NEDQ)

Parameter	**Night Eating Syndrome (NEDQ)**				**Total**	***p*-value**
	Normal	*Mild*	*Moderate*	*Full Syndrome*		
BMI *(Mean ± SD)*	24.96 ± 3.93	24.88 ± 4.99	27.03 ± 3.83	27.63 ± 5.22	25.99 ± 4.60	
Underweight	1 (2.3%)	1 (6.3%)	0 (0.0%)	1 (3.4%)	3 (2.9%)	
Normal	23 (53.5%)	11 (68.8%)	5 (35.7%)	7 (24.1%)	46 (45.1%)	<0.05
Overweight	13 (30.2%)	2 (12.5%)	7 (50.0%)	13 (44.8%)	35 (34.3%)	
Class 1 Obesity	5 (11.6%)	2 (12.5%)	1 (7.1%)	6 (20.7%)	14 (13.7%)	
Class 2 Obesity	1 (2.3%)	0 (0.0%)	1 (7.1%)	2 (6.9%)	4 (3.9%)	
Waist-Hip Ratio *(Mean ± SD)*	0.92 ± 0.06	0.91 ± 0.07	0.95 ± 0.05	0.96 ± 0.08	0.93 ± 0.07	
High Health Risk	29 (67.4%)	7 (43.8%)	14 (100.0%)	23 (79.3%)	73 (71.6%)	<0.05
Moderate Health Risk	4 (9.3%)	4 (25.0%)	0 (0.0%)	4 (13.8%)	12 (11.8%)	
Lower Health Risk	10 (23.3%)	5 (31.3%)	0 (0.0%)	2 (6.9%)	17 (16.7%)	
PSQI *(Mean ± SD)*	5.26 ± 2.88	6.31 ± 2.96	11.64 ± 3.61	14.41 ± 1.94	8.90 ± 4.89	
Good SQ[1]	27 (62.8%)	6 (37.5%)	1 (7.1%)	0 (0.0%)	34 (33.3%)	<0.001
Average SQ[1]	14 (32.6%)	9 (56.3%)	3 (21.4%)	2 (6.9%)	28 (27.5%)	
Poor SQ[1]	2 (4.7%)	1 (6.3%)	8 (57.1%)	20 (69.0%)	31 (30.4%)	
Very Poor SQ[1]	0 (0.0%)	0 (0.0%)	2 (14.3%)	7 (24.1%)	9 (8.8%)	
ISI *(Mean ± SD)*	5.58 ± 4.28	7.81 ± 6.10	15.21 ± 6.32	20.31 ± 2.12	11.44 ± 7.78	
No Insomnia	32 (74.4%)	9 (56.3%)	1 (7.1%)	0 (0.0%)	42 (41.2%)	
Subthreshold Insomnia	10 (23.3%)	3 (18.8%)	5 (35.7%)	0 (0.0%)	18 (17.6%)	<0.001
Clinical Insomnia (MS)[2]	1 (2.3%)	4 (25.0%)	6 (42.9%)	22 (75.9%)	33 (32.4%)	
Clinical Insomnia (S)[3]	0 (0.0%)	0 (0.0%)	2 (14.3%)	7 (24.1%)	9 (8.8%)	
Anxiety & Depression *(Mean ± SD)*	3.58 ± 3.43	3.88 ± 2.75	6.50 ± 2.10	8.03 ± 1.82	5.29 ± 3.38	
Normal	20 (46.5%)	6 (37.5%)	1 (7.1%)	0 (0.0%)	27 (26.5%)	<0.001
Mild	14 (32.6%)	7 (43.8%)	2 (14.3%)	2 (6.9%)	25 (24.5%)	
Moderate	4 (9.3%)	2 (12.5%)	8 (57.1%)	13 (44.8%)	27 (26.5%)	
Severe	5 (11.6%)	1 (6.3%)	3 (21.4%)	14 (48.3%)	23 (22.5%)	

SD = Standard Deviation. [1]**SQ** = Sleep Quality. [2]**MS** = Moderate Severity Clinical Insomnia (ISI). [3]**S** = Severe Clinical Insomnia (ISI). Continuous Variables is presented as both Mean ± SD and through categorical grouping as N (%).

Sleep quality parameters demonstrated even stronger associations with NES severity than the anthropometric measures previously described. Analysis of PSQI scores revealed an extremely strong positive correlation with NES prevalence that was highly significant ($p < 0.001$, $r = 0.816$). Mean PSQI scores increased progressively across NES categories:

5.26 ± 2.88 for normal participants, 6.31 ± 2.96 for mild syndrome, 11.64 ± 3.61 for moderate syndrome, and 14.41 ± 1.94 for full syndrome. Among participants with full syndrome NES, 69.0% reported poor sleep quality while 24.1% experienced very poor sleep quality, representing a supermajority with significant sleep disturbances. Even within the moderate syndrome group, 57.1% had poor sleep quality, 14.3% had very poor sleep quality, and an additional 21.4% experienced some degree of sleep problems. Notably, only 62.8% of participants without NES achieved optimal sleep quality scores. Insomnia Severity Index (ISI) scores demonstrated similarly strong correlation and significance with NES ($p < 0.001$, $r = 0.815$). Mean ISI scores showed linear progression across categories: 5.58 ± 4.28 for normal, 7.81 ± 6.10 for mild syndrome, and 20.31 ± 2.12 for full syndrome (approaching the maximum score of 21). Among participants with full syndrome NES, 75.9% exhibited moderate clinical insomnia while the remaining 24.1% met criteria for severe clinical insomnia. Conversely, 74.4% of participants without NES showed no signs of clinical insomnia.

Table 5.5: Correlation Chart between Night Eating Syndrome (NEDQ) & Anthropometric and Psychological Characteristics, Sleep Quality

	NES	**BMI**	**Waist-Hip Ratio**	**PSQI**	**ISI**	**Anxiety & Depression**
NES	–					
BMI	0.259	–				
Waist-Hip Ratio	0.298	0.269	–			
PSQI	0.816	0.351	0.348	–		
ISI	0.815	0.288	0.289	0.866	–	
Anxiety & Depression	0.572	0.279	0.211	0.574	0.618	–

Psychological parameters demonstrated similarly strong associations with NES severity, showing high positive correlation with extreme significance for combined anxiety and depression measures ($p < 0.001$, $r = 0.572$). Among participants with full syndrome NES, 48.3% experienced severe anxiety and depression while 44.8% had moderate symptoms, indicating that the vast majority suffered from clinically significant psychological distress. Within the moderate NES group, 57.1% presented with moderate anxiety and depression, whereas both normal and mild NES categories showed substantially lower rates of moderate symptoms (less than 20% in each group). For participants without NES, 46.5% reported

no anxiety or depression issues and 32.6% experienced only mild symptoms. Similarly, among those with mild NES, 37.5% had no psychological symptoms while 43.8% reported mild anxiety and depression, demonstrating that milder forms of NES are associated with correspondingly lower levels of psychological distress.

Chapter 6

Discussions

The current study indicates a much greater frequency of Night Eating Syndrome in suburban Kolkata compared to prior findings in international literature, with 57.84% of participants exhibiting some degree of NES and 28.43% meeting criteria for full syndrome. This prevalence markedly exceeds rates of around 2.0-8.0% typically observed in general populations globally (Rand et al., 1997; Striegel-Moore et al., 2006; Calugi et al., 2009; Blouchou et al., 2024; Kim et al., 2023). The primary reason behind this might be attributed to the composition of the population sample as well as on lifestyle factors and cultural factors as discussed below.

Night Eating Syndrome (NES) arises from a complex interplay of circadian dysregulation, hormonal imbalances, and sleep disturbances, rooted in disruptions to the body's central biological clock (Meléndez-Fernández et al., 2023). The suprachiasmatic nucleus (SCN) of the hypothalamus, which orchestrates the circadian rhythm, is highly sensitive to light cues. Exposure to artificial light at night (ALAN) desynchronizes the SCN from peripheral clocks in metabolic tissues, leading to misalignment in the timing of hormone release and behavioral patterns. This circadian disruption alters the secretion of key metabolic hormones: melatonin production is suppressed, reducing sleep initiation and weakening feedback to the SCN; cortisol, typically peaking in the early morning, may rise at night, promoting alertness and increased glucose availability; and the appetite-regulating hormones leptin and ghrelin become imbalanced, with decreased leptin (reducing satiety) and elevated ghrelin (increasing hunger), especially during the biological night.

These hormonal shifts foster a physiological drive to eat at night, despite the body's re-

duced capacity to metabolize food during this period. Concurrently, sleep-regulating neural circuits within the hypothalamus are impaired by circadian misalignment. Reduced activity in the sleep-promoting preoptic area and dysregulation in the dorsomedial hypothalamus result in poor sleep quality and increased nighttime wakefulness. This sleep disruption further amplifies hormonal imbalances, creating a feedback loop in which inadequate sleep increases hunger, and night eating further impairs sleep. Together, these factors generate the hallmark features of NES: delayed circadian phase, nocturnal hyperphagia, and insomnia. Over time, this cycle promotes insulin resistance, glucose intolerance, and weight gain, increasing the risk for metabolic syndrome and cardiovascular disease (Dias et al., 2023; Vander Wal, 2012). Thus, NES reflects a breakdown in the temporal coordination of physiological processes, driven by environmental and behavioral factors that misalign internal clocks, disrupt hormonal homeostasis, and impair sleep-wake regulation.

A notable finding was the strong positive correlation between age and NES severity ($r = 0.565$, $p < 0.001$), with mean age increasing linearly from 25.14 ± 5.72 years in participants without NES to 34.72 ± 4.04 years in those with full syndrome—a demographic pattern that has received limited attention in previous general population studies. This age-related prevalence may be attributed to the study's focus on the 20-40 age range, which represents one of the most professionally and socially active periods of life. Several former studies by Striegel-Moore et al. (2006) and Sakthivel et al. (2023) have identified NES prevalence peaks in both adolescent and adult populations, suggesting that NES susceptibility may be directly proportional to lifestyle stressors, as factors like occupational demands and life pressures intensify the tendency toward disordered eating patterns (Anthonisamy et al., 2022; Murthy et al., 2024). This age-related pattern likely reflects cumulative effects of life stressors, changing metabolic factors, or evolving sleep patterns that contribute to nocturnal eating behaviors (Farhangi, 2019; Gan et al., 2019; Gundogdu & Yildirim, 2023). The concentration of full syndrome cases in the 31-35 age group (44.8%) and moderate cases in the 36-40 group (50.0%) suggests that the fourth decade of life may represent a critical period for NES development, whereas adolescents and young adults typically exhibit milder manifestations of such eating disorders (AHMAD et al., 2019; Potterton et al., 2020).

Gender analysis revealed no significant differences in NES prevalence ($p > 0.05$), which aligns with multiple studies examining NES across diverse populations (Arslan et al., 2015; Striegel-Moore et al., 2006; Lundgren et al., 2010). While some studies suggest women may be more susceptible to NES (Almuammar et al., 2024) and others indicate the opposite pattern (Dias et al., 2023), Night Eating Syndrome appears to exhibit context-dependent prevalence patterns that vary across different populations and cultural settings. The higher prevalence of severe NES among married individuals (79.3% in full syndrome) presents an intriguing finding requiring careful interpretation. Although marriage is typically associated with improved health outcomes (Robles et al., 2014), this relationship may be confounded by age, given that older participants (who demonstrated higher NES rates) are more likely to be married. Alternatively, this pattern might reflect shared household eating behaviors, disrupted meal timing patterns, or family-related stress-related issues that contribute to nocturnal eating behaviors (Wichianson et al., 2009).

The significant associations between NES and both personal hypertensive status and family history of hypertension ($r = 0.273$, $p < 0.05$) provide compelling evidence for shared pathophysiological mechanisms underlying these conditions. These findings align with emerging research documenting connections between circadian rhythm disruption and cardiovascular health (Scheer et al., 2009). Night eating inherently disrupts normal circadian metabolic patterns, potentially contributing to insulin resistance, altered glucose metabolism, and subsequent cardiovascular risk factors (Meléndez-Fernández et al., 2023). Similarly, the correlation with family history of obesity ($r = 0.255$, $p < 0.05$) suggests potential genetic or familial environmental components influencing NES development, consistent with research indicating heritable factors in eating disorder susceptibility (Bulik et al., 2006). Notably, the absence of association with diabetes family history, despite the clear metabolic implications of nocturnal eating patterns, may reflect the complex polygenic nature of diabetes susceptibility or insufficient statistical power to detect this particular relationship in the current sample.

The current study's results about the correlation between Body Mass Index and Night Eating Syndrome corroborate and enhance the previous literature, which illustrates a robust bidirectional relationship between weight status and nocturnal eating practices.

The results revealed a significant positive correlation between BMI and NES severity ($r = 0.259$, $p < 0.05$), with mean BMI values progressively increasing from 24.96 ± 3.93 kg/m² in participants without NES to 27.63 ± 5.22 kg/m² in those with full syndrome. This progressive pattern is consistent with Lundgren et al. (2006), who reported escalating NES prevalence rates corresponding with weight status: approximately 6% in normal weight individuals, 8% in overweight individuals, and up to 28% in severely obese individuals. The proportion of overweight participants in our study increased substantially from 30.2% among those without NES to 44.8% among those with full syndrome, while Class I obesity prevalence rose from 11.6% to 20.7% respectively. These findings support the meta-analysis by Gallant et al. (2012), which confirmed significantly high BMI levels in individuals with NES compared to those without the syndrome. The mechanisms underlying this relationship, as described by Goel et al. (2009) and Allison et al. (2010), include increased total daily caloric intake through nocturnal eating episodes, consumption of energy-dense comfort foods during nighttime hours, metabolic disruptions due to circadian rhythm misalignment, and reduced physical activity resulting from fatigue associated with poor sleep quality. Our findings are particularly noteworthy given that the mean BMI values in the full syndrome group approach the overweight category threshold, suggesting that even moderate NES severity may contribute to clinically significant weight management challenges.

The Waist-Hip Ratio findings in our study provide compelling evidence for the association between central adiposity and Night Eating Syndrome, demonstrating an even stronger correlation ($r = 0.298$, $p < 0.05$) than BMI with NES severity. Mean WHR values increased from optimal levels (0.92 ± 0.06) in participants without NES to 0.96 ± 0.08 in those with full syndrome, indicating a shift toward central fat distribution patterns associated with increased cardiometabolic risk. Most striking was the observation that participants categorized as having high health risk based on WHR were substantial across all NES categories, ranging from 43.8% among those without NES to 100% in the moderate syndrome group, while only 23.3% of participants without NES fell into the lower health risk category. This pattern suggests that NES may be particularly associated with visceral adiposity rather than overall body weight alone, which aligns with the metabolic

disruptions described by Abo El-Ela et al. (2022) involving circadian rhythm misalignment and hormonal dysregulation. The elevated WHR values across NES categories may reflect the consumption patterns characteristic of night eating episodes, which typically involve energy-dense, high-carbohydrate foods that promote central fat accumulation. This finding has significant clinical implications, as central adiposity measured by WHR is a stronger predictor of cardiovascular disease, type 2 diabetes, and metabolic syndrome than BMI alone. The relationship between NES and central adiposity may explain why Atik et al. (2019) found that 13% of morbidly obese patients awaiting bariatric surgery met criteria for NES, with these patients showing significantly higher rates of psychiatric disorders and depression, suggesting that the metabolic consequences of central adiposity may exacerbate the psychological components of NES, creating the self-perpetuating cycle described by Lundgren et al. (2006) where metabolic dysfunction, sleep disruption, and psychological distress mutually reinforce nocturnal eating behaviors.

The sleep quality findings represent the most compelling evidence from this study, with PSQI scores demonstrating an exceptionally strong positive correlation with NES severity ($r = 0.816$, $p < 0.001$) that surpasses correlations reported in most previous literature. Mean PSQI scores increased dramatically across NES categories, from 5.26 ± 2.88 in normal participants to 14.41 ± 1.94 in those with full syndrome, indicating a progression from good sleep quality to severe sleep disturbances. This finding aligns with and extends the work of Hamurcu (2022), who reported significant negative correlations between sleep quality and NES among Turkish university students, though our correlation strength exceeds previously documented associations. The clinical significance becomes evident when examining categorical distributions: 69.0% of full syndrome participants reported poor sleep quality while 24.1% have reported to have very poor sleep quality, representing a 93.1% prevalence of significant sleep disturbances in this group. Even participants with moderate NES showed substantial sleep impairment, with 57.1% having poor sleep quality and 14.3% having very poor sleep quality. The Insomnia Severity Index results further corroborate these findings, showing an equally strong correlation ($r = 0.815$, $p < 0.001$) with mean ISI scores approaching the maximum value of 21 in full syndrome participants (20.31 ± 2.12). Remarkably, 75.9% of full syndrome participants exhibited moderate clini-

cal insomnia while 24.1% met criteria for severe clinical insomnia, indicating universal insomnia prevalence in this group. These findings support the bidirectional relationship described by Kazgan Kılıçaslan et al. (2024), who found that sleep problems directly predicted night eating syndrome, and align with the mechanisms proposed by Birketvedt (1999) involving disrupted sleep architecture and frequent nocturnal awakenings. The underlying neuroendocrine dysregulation involving serotonin, melatonin, leptin, and cortisol rhythms, as described by Mohamad and Hamirudin (2023) and O'Reardon et al. (2005), may explain why our study found such robust correlations between sleep disturbances and nocturnal eating behaviors, suggesting that the circadian rhythm disruption characteristic of NES creates a self-reinforcing cycle where sleep disruption promotes night eating, which further compromises sleep quality.

The psychological dimension of Night Eating Syndrome emerged as another critical component in our study, with anxiety and depression measures showing a strong positive correlation with NES severity ($r = 0.572$, $p < 0.001$) that supports the extensive literature documenting the relationship between psychological distress and nocturnal eating behaviors. Within participants of full syndrome NES, 48.3% experienced severe anxiety and depression while 44.8% had moderate symptoms, indicating that 93.1% of individuals with full syndrome NES suffered from clinically significant psychological distress. This prevalence substantially exceeds the rates reported by KÜÇÜKGÖNCÜ and BEŞTEPE (2014), who found major depression in 22% of NES patients, though their study examined psychiatric outpatients rather than a general population sample. The progressive nature of psychological symptoms across NES categories in our study—with moderate NES showing 57.1% moderate anxiety and depression, compared to less than 20% in both normal and mild categories—mirrors the findings of Orhan et al. (2011), who indicated that individuals with depression were 2.64 times more predisposed to acquire NES. The stark contrast between participants without NES (46.5% with no psychological symptoms) and those with full syndrome (only 6.9% with mild or no symptoms) underscores the profound psychological burden associated with severe nocturnal eating behaviors. These findings align with the neurobiological mechanisms proposed by Birketvedt (1999), who documented elevated cortisol levels in night eaters, and support Gundogdu (2022) pathway

model demonstrating that sleep problems influence NES through depression and stress pathways. The high prevalence of psychological distress in our NES participants may reflect the maladaptive coping strategy described by Vander Wal (2012), where individuals use nighttime eating to regulate negative emotions, creating the self-perpetuating cycle identified by Lundgren et al. (2006) where emotional distress triggers night eating, which disrupts sleep and further exacerbates psychological symptoms. The clinical implications are particularly concerning given that KÜÇÜKGÖNCÜ and BEŞTEPE (2014) reported significantly higher rates of suicide attempts among NES patients (36.2% vs. 20.9%), highlighting the urgent need for comprehensive treatment strategies that target both eating patterns and the underlying psychological problems in this demographic.

Chapter 7

Conclusion

This cross-sectional study represents one of the first comprehensive investigations of Night Eating Syndrome (NES) in the Indian context, specifically examining adults aged 20-40 years in suburban regions of Kolkata. The findings indicate a substantially higher prevalence of NES than previously documented in international literature, with 57.84% of participants exhibiting some degree of NES and 28.43% meeting criteria for full syndrome, significantly exceeding the 1.1-5.7% rates typically reported in general populations globally. The study identified numerous significant correlations that improve our knowledge of NES expression and its diverse health consequences. A strong positive correlation between age and NES severity identified the fourth decade of life as a particularly vulnerable period, with individuals aged 31-40 years showing the highest prevalence of moderate to severe NES. Most significantly, the study documented exceptionally strong correlations between NES and sleep disturbances, with both Pittsburgh Sleep Quality Index scores and Insomnia Severity Index scores demonstrating remarkable associations that surpass previously reported relationships in the literature and provide compelling evidence for the bidirectional relationship between sleep disruption and nocturnal eating behaviors. The psychological dimension emerged as equally critical, with 93.1% of full syndrome participants suffering from clinically significant anxiety and depression, while anthropometric findings revealed important associations between NES and both overall adiposity and central fat distribution, suggesting that NES may preferentially contribute to visceral adiposity with significant implications for cardiovascular disease risk and metabolic syndrome development.

This research fills a notable void in the literature by delivering the inaugural com-

prehensive evaluation of NES across various demographic profiles in India, analyzing adults from diverse socioeconomic backgrounds, occupations, and cultural contexts, rather than concentrating exclusively on university students and adolescents as previous Indian studies have done. The study's methodological approach, employing the hierarchical scoring method of the Night Eating Diagnostic Questionnaire (NEDQ), remains significantly underexplored in research literature, particularly in non-Western populations, and captured subtle variations across multiple anthropometric measures and psychometric scales. The substantially elevated prevalence of NES documented in this study has significant public health implications for India, particularly given the country's rapidly changing lifestyle patterns, increasing urbanization, and evolving dietary habits, with the strong associations with hypertension, family history of cardiovascular disease, and central adiposity indicating that NES may exacerbate the increasing prevalence of non-communicable diseases in urban and suburban Indian populations. The findings highlight the urgent need for healthcare providers to screen for nocturnal eating behaviors, particularly among individuals presenting with sleep disturbances, anxiety, depression, or weight management concerns, and emphasize that treatment approaches must be comprehensive and multidisciplinary, incorporating sleep hygiene education, stress management strategies, and mental health support alongside nutritional counseling.

This study offers significant insights into NES within the Indian context; however, the sample size of 102 participants, while adequate for exploratory aims, constrains the generalizability of the findings to larger Indian populations, and the cross-sectional design inhibits the establishment of causal relationships between NES and its associated factors. Subsequent studies ought to encompass larger, more geographically varied samples across different regions of India to account for cultural, dietary, and lifestyle variations, with longitudinal studies tracking the development of NES over time to provide crucial insights into risk factors, protective factors, and natural progression patterns, alongside intervention studies examining culturally appropriate treatment approaches tailored to Indian populations. This study establishes Night Eating Syndrome as a significant health concern in suburban Indian populations, with prevalence rates substantially exceeding those reported internationally, and the exceptionally strong associations documented between

NES and sleep disturbances, psychological distress, and cardiometabolic risk factors underscore the syndrome's multifaceted nature and its possible impact on the prevalence of non-communicable diseases in India. The findings emphasize that NES cannot be viewed merely as an isolated eating behavior but rather as part of a complex constellation of sleep, psychological, and metabolic disturbances that require comprehensive, integrated treatment approaches, with the age-related patterns suggesting that the fourth decade of life represents a critical intervention window. As India continues to experience rapid socioeconomic development and lifestyle transitions, understanding and addressing eating disorders like NES becomes increasingly critical for public health planning, and this research provides essential baseline data for the Indian context while establishing a foundation for future investigations aimed at developing culturally appropriate prevention and intervention strategies, with the urgent need for increased awareness among healthcare providers, development of culturally sensitive screening tools, and implementation of comprehensive treatment approaches that can effectively address the significant burden of Night Eating Syndrome in Indian populations.

Limitations of the Study

This study contains multiple limitations that must be recognized when evaluating the results.

- **Sample Size and Generalizability:** The limited sample size (N=102) constrains statistical power and the generalizability to the wider Indian population. The sample was primarily drawn from suburban Kolkata and included a significant proportion of university students and faculty, which may not represent diverse socioeconomic, cultural, and geographical contexts across India, particularly rural populations.

- **Cross-sectional Design:** The cross-sectional nature precludes establishing causal relationships between NES and associated factors such as sleep quality, psychological distress, and anthropometric measurements. While strong correlations were identified, longitudinal studies would be necessary to determine temporal sequences and bidirectional relationships.

- **Self-report Bias:** The study relied primarily on self-report questionnaires, introducing potential reporting bias, social desirability bias, and recall bias. Objective assessments, using actigraphy, polysomnography, or dietary logs, would yield more precise data regarding nighttime feeding practices and sleep patterns.
- **Selection Bias:** Convenience sampling and recruitment primarily from academic institutions may have introduced selection bias toward educated individuals with greater health awareness. Additionally, individuals with severe psychological distress or eating disorders may have been less likely to participate, potentially underestimating severe cases.
- **Diagnostic Method:** The study relied on questionnaire-based assessment rather than clinical interviews, which are regarded as the benchmark for diagnosing eating disorders. While the Night Eating Diagnostic Questionnaire has demonstrated validity, clinical confirmation would strengthen diagnostic accuracy.

Despite these limitations, this study provides valuable preliminary data on NES in the Indian context and establishes important associations that warrant further investigation through larger, longitudinal studies with more diverse sampling strategies.

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Annexure A

Sample Questionnaire used for the Study

This is the questionnaire tailored for the purposes of this study, which consists of sociodemographic questions along with ***Night Eating Diagnostic Questionnaire, Pittsburgh Sleep Quality Index Questionnaire, Insomnia Severity Index Questionnaire*** *and* ***PHQ-4****.*

NIGHT EATING SYNDROME QUESTIONNAIRE

Greetings for you,

I'm a student of Msc. Applied Nutrition and Dietetics from Sister Nivedita University .

You are invited to participate in a survey on the prevalence of Night Eating Syndrome (NES) and obesity among 20 to 40-year-olds. The survey will take about 10-15 minutes and includes questions about your lifestyle, dietary habits, and health. Your responses will remain confidential and anonymous, used solely for research purposes. By proceeding, you confirm that you understand the purpose, agree to participate, and are aged between 20 and 40 years. Thank you for your time and contribution!

General Information :

- Name: _____
- Age: _____ years
- Gender : [ ] Male [ ] Female [ ] Other [ ] Prefer not to say
- Marital Status: [ ] Single [ ] Married [ ] Divorced [ ] Widowed [ ] Other: _____
- Education Level:

[ ] Less than High School [ ] High School/GED [ ] Bachelor's Degree [ ] Master's Degree
[ ] Doctoral Degree [ ] Other: _____

- Height (in cm) :_____
- Weight (in kg) :_____
- Waist circumference (in cm): _____
- Hip circumference (in cm) :_____
- Blood pressure (in mm of hg) : _____
- Family history of obesity / Hypertention / Hyperglycemia (Diabetes) :

  [ ] Present. [ ] Absent

- Smoking:
  [ ] Present. [ ] Absent [ ] Count per day (If present) _____
- Drinking :
  [ ] Present [ ] Abesnt [ ] Amount / frequency _____

Night Eating Assessment

Please answer the following questions carefully and be sure to answer each question.

1. What time do you usually go to bed in the evening (turn out the lights in order to go to sleep)?

_____ pm

2. What time do you usually get out of bed in the morning?

_____ am

3. On most days, do you experience loss of appetite in the morning?

[ ] No [ ] Yes

4. How often do you typically eat breakfast (after your final morning awakening)?

   _____ times/week

5. What time do you usually have the first meal of the day? _____ (am/pm)
6. How much food do you generally eat after 7 p.m. as a percentage (%) from 0-100? (Please be specific, for example, 15%)

   _____% (0-100)

7. What time do you usually have your dinner? _____ pm
8. How much food do you generally eat after your dinner as a percentage (%) from 0-100? (Please be specific, for example, 15%). _____% (0-100)

8a. For how long have you been consuming at least this much after your dinner?

Years: _____

Months: _____

9. On most days, do you have a strong urge to eat between dinner and sleep onset and/or during the night?

   [ ] No [ ] Yes

10. Do you have trouble falling asleep at night?

[ ] No [ ] Yes

10a. If YES, how many times each week? _____ times/week

11. Do you have trouble staying asleep at night?

[ ] No [ ] Yes

11a. If YES, how many times each week? _____ times/week

11b. If YES, how many times each week do you get out of bed during these awakenings?

_____ times/week [ ] none

12. How many times each week do you awake from sleep during the night to use the bathroom?

_____ times/week [ ] none

13. Do you awake from sleep during the night and eat food?

[ ] No (Skip to Question 14) [ ] Yes

13a. If yes, how many times per week ? _____ times/week

13b. For how long have you been getting up at this frequency to eat?

Years: _____ Months: _____

13c. Do you believe you need to eat in order to fall back to sleep when you wake up at night?

[ ] No [ ] Yes

13d. How aware are you of your eating during the night?

[ ] Not at all [ ] Somewhat [ ] Extremely

13e. How often do you recall your eating during the night the next day?

[ ] Never [ ] Sometimes [ ] Always

14. Would you consider yourself a night eater?

[ ] No (Skip to Question 15) [ ] Yes

If **YES**, please answer the following**:**

14a. How upset are you about your night eating?

[ ] Not at all [ ] Somewhat [ ] Extremely

14b. How much has your eating at night impaired your functioning and/or interfered with your daily life?

[ ] Not at all [ ] Somewhat [ ] Extremely

14c. For how long have you been experiencing this night eating behavior?

[ ] Less than 3 months [ ] 3-6 months [ ] 6-12 months [ ] More than 1 year

15. Do you have sleep apnea?

[ ] No [ ] Yes [ ] Don't know

16. Do you work an evening or night shift?

[ ] No [ ] Yes

16a. IF YES, is it:

[ ] Evening [ ] Night [ ] Rotating

16b. IF YES, for how long have you been working this shift?

Years: _____ Months: _____

17. Have you been feeling depressed or down nearly every day?

[ ] No [ ] Yes

18. In general, when you are feeling depressed or down, is your mood lower in the:

[ ] Morning [ ]Afternoon [ ] Evening/nighttime [ ] Not applicable

19. Are you currently dieting to lose weight?

[ ] No [ ] Yes

19a. IF YES, how much weight have you lost in the past 3 months? _____ kg

21. Please take a moment to review your responses. Have you answered each question completely?
[ ] No [ ] Yes

INSOMNIA SEVERITY INDEX (ISI)

1. Please rate the current (i.e., last 2 weeks**) SEVERITY** of your insomnia problem(s):

- Difficulty falling asleep:

None (0). Mild (1) Moderate (2). Severe (3) Very (4)

- Difficulty staying asleep:

None (0) Mild (1) . Moderate (2). Severe (3) Very (4)

- Problem waking up too early:

None (0) Mild (1) Moderate (2) Severe (3) Very (4)

2. How SATISFIED/dissatisfied are you with your current sleep pattern?

Very Satisfied _____Very Dissatisfied

0 1 2 3 4

3. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g., daytime fatigue, ability to function at work/daily chores, concentration, memory, mood, etc.)?

Not at all Interfering A Little. Somewhat Much Very Much Interfering

0 1 2 3 4

4. How NOTICEABLE to others do you think your sleeping problem is in terms of impairing the quality of your life?

Not at all Noticeable Barely Somewhat. Much Very Much Noticeable

0 1 2 3 4

5. How WORRIED/distressed are you about your current sleep problem?

Not at all A Little Somewhat Much Very Much

0 1 2 3 4

PITTSBURGH SLEEP QUALITY INDEX (PSQI)

Please answer all questions.

1. During the past month, what time have you usually gone to bed at night?

BED TIME: _____

2. During the past month, how long (in minutes) has it usually taken you to fall asleep each night?

NUMBER OF MINUTES: _____

3. During the past month, what time have you usually gotten up in the morning?

GETTING UP TIME: _____

4. During the past month, how many hours of actual sleep did you get at night? (This may be different than the number of hours you spent in bed.)

HOURS OF SLEEP PER NIGHT: _____

For each of the remaining questions, check the one best response. Please Answer all questions.

5. During the past month, how often have you had trouble sleeping because you…

a) Cannot get to sleep within 30 minutes

Not during the Past month _____	Less than once a week_____	Once or twice a week _____	Three or more Time_____

b) Wake up in the middle of the night or early morning

Not during the Past month _____	Less than once a week _____.	Once or twice a week _____.	Three or more Time _____

c) Have to get up to use the bathroom

Not during the Past month _____	Less than once a week _____.	Once or twice a week _____.	Three or more Time _____

d) Cannot breathe comfortably

Not during the Past month _____	Less than once a week _____.	Once or twice A week _____.	Three or more Time _____

e) Cough or snore loudly

Not during the Past month _____	Less than once a week _____.	Once or twice A week _____.	Three or more Time _____

f) Feel too cold

Not during the Past month _____	Less than once a week _____.	Once or twice A week _____.	Three or more Time _____

g) Feel too hot

Not during the Past month _____	Less than once a week _____.	Once or twice A week _____.	Three or more Time _____

h) Had bad dreams

Not during the Past month _____	Less than once a week _____.	Once or twice A week _____.	Three or more Time _____

i)Have pain

Not during the Past month _____ | Less than once a week _____. | Once or twice A week _____. | Three or more Time _____

j) Other reason(s), please describe:

_____

k. How often during the past month have you had trouble sleeping because of this?

Not during the Past month _____ | Less than once a week _____. | Once or twice A week _____. | Three or more Time _____

6) During the past month, how would you rate your sleep quality overall?

Very good _____ Fairly good _____ Fairly bad _____Very bad. _____

7) During the past month, how often have you taken medicine (prescribe or "over the counter") to help you sleep?

Not during the Past month _____ | Less than once a week _____. | Once or twice A week _____. | Three or more Time _____

8) During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the Past month _____ | Less than once a week _____. | Once or twice A week _____. | Three or more Time _____

9) During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

No problem at all [ ] | Only a very slight problem [ ] | Somewhat a problem [ ] | A very big problem [ ]

10) Do you have a bed partner or roommate?

No bed partner or Roommate _____ | Partner/roommate in other room_____ | Partner in same room but not same bed_____ | Partner in same bed_____

If you have a room mate or bed partner, ask him/her how often in the past month you have had…

a) Loud snoring

Not during the Past month _____ | Less than once a week _____. | Once or twice A week _____. | Three or more Time _____

b) Long pauses between breaths while asleep

Not during the Past month _____ | Less than once a week _____. | Once or twice A week _____. | Three or more Time _____

c) Legs twitching or jerking while you sleep

Not during the	Less than	Once or twice	Three or more
Past month _____	once a week _____.	A week _____.	Time _____

d) Episodes of disorientation or confusion during sleep

Not during the	Less than	Once or twice	Three or more
Past month _____	once a week _____.	A week _____.	Time _____

e) Other restlessness while you sleep, please describe:

Not during the	Less than	Once or twice	Three or more
Past month _____	once a week _____.	A week _____.	Time _____

PHQ-4: THE FOUR-ITEM PATIENT HEALTH QUESTIONNAIRE FOR ANXIETY AND. DEPRESSION

Over the last two weeks, how often have you been bothered by the following problems?

1. Feeling nervous, anxious or on edge :-

Not at all	**Several days**	**More than half the day**	**Nearly every day**
0	1	2.	3

2. Not being able to stop or control worrying :-

Not at all	**Several days**	**More than half the day**	**Nearly every day**
0	1	2.	3

3. Feeling down, depressed or hopeless

Not at all	**Several days**	**More than half the day**	**Nearly every day**
0	1	2.	3

4. Little interest or pleasure in doing things

Not at all	**Several days**	**More than half the day**	**Nearly every day**
0	1	2.	3

TOTALS _____

Signature : _____

Annexure B

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